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PROJECT NO. 51840

RULEMAKING ESTABLISHING ELECTRIC WEATHERIZATION STANDARDS	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

INITIAL COMMENTS OF AEP TEXAS INC. AND ELECTRIC TRANSMISSION TEXAS LLC

AEP Texas Inc. and Electric Transmission Texas LLC (collectively in this proceeding as "AEP Companies") provide these comments in response to the Public Utility Commission of Texas ("Commission") Staff's June 6, 2021, request for comments in Project No. 51840, *Rulemaking Establishing Electric Weatherization Standards*.

I. INTRODUCTION

The AEP Companies appreciate the opportunity to submit initial comments in response to the Commission Staff's Question 2 regarding new PURA § 38.075(a) as it relates to weatherization of transmission facilities in the ERCOT region. The AEP Companies file these comments to address the following question posed by the Commission Staff:

> 2. To fulfill the requirements of Texas Utilities Code § 38.075(a), under what weather emergency conditions should the Commission require an electric cooperative, municipally owned utility, or transmission and distribution utility providing transmission service in the ERCOT power region to be able to operate its transmission facilities? At a minimum, please address standards for temperature, icing, wind, flooding, and drought conditions. For each, please address whether the standard should vary by region or by type of generation facility. Please provide any relevant support for your recommendations, including existing or proposed standards in other jurisdictions, or related studies.

New Section 38.075(a) requires the Commission to adopt rules to require each electric cooperative, municipally owned utility, and transmission and distribution utility providing transmission service in the ERCOT power region to implement measures to prepare the cooperative's or utility's facilities to maintain service quality and reliability during a weather emergency according to standards adopted by the Commission. The AEP Companies believe that the Commission's rules and the suite of existing standards and codes provide for reliability and service quality for transmission facilities and services, including operations during weather emergency conditions such as temperature, icing, wind, flooding, and drought conditions. The AEP Companies design, maintain and operate our transmission facilities consistent with existing federal and state standards, codes and industry best practices addressing each of the weather emergency conditions identified by the Commission Staff. Existing standards and codes incorporate regional variations, and any new or additional standards should allow for such considerations in the planning and operations of the transmission system. The AEP Companies are not aware of a need for variations by type of generation facility.

While the AEP Companies' experience confirms that no new standards are necessary, it also reveals that older facilities are vulnerable due to the less stringent design criteria that were in place at time those facilities were built. Addressing this aging infrastructure is important and the AEP Companies welcome the Commission's support in addressing this "need" as a criteria in Certificate of Convenience and Necessity (CCN) proceedings. Additionally, AEP believes the current transmission planning criteria should be expanded to include N-1-1 planning during peak times with no non-consequential load shed. This would more closely align system planning with the way the system is actually operated and result in a more robust transmission system that is able to better withstand extreme weather events. In the recent February 2021 winter storm event, the AEP Companies' transmission facilities did not experience broad failures and performed well under the circumstances. The AEP Companies provide additional supporting information and details regarding the standards and codes addressing the conditions identified by Commission Staff in the sections below.

II. DISCUSSION

The power grid is one of the most complex machines ever built by man. It is comprised of many individual components (poles, insulators, conductors, breakers, relays, etc.) that in aggregate comprise individual assets and facilities (transmission lines, substations, communications networks, etc.) that operate together as integral pieces of a much larger, complex and highly interconnected network. The expectations associated with the performance of the power grid are daunting – instantaneously match all supply resources to meet all energy demands around-the-clock with a high level of reliability and under a diverse set of environmental and operating conditions. It is critical that each of the individual components, assets, facilities and the larger interconnected network are designed, constructed, operated and maintained in a manner commensurate with these high expectations.

There are numerous industry standards, guidelines and criteria related to the design, operation and maintenance of transmission facilities and the interconnected transmission network including, but not limited to, American National Standards Institute (ANSI), National Electrical Safety Code (NESC), Institute of Electrical and Electronics Engineers (IEEE), American Society of Civil Engineers (ASCE) and the North American Electric Reliability Corporation (NERC). These standards specify criteria related to weather, strength, clearance and operational requirements as well as providing guidance for the design of transmission facilities and criteria by which to judge the performance of the transmission network. The industry continues to evaluate and revise codes and criteria as the science improves and as additional data becomes available.

The AEP Companies believe that the current standards and codes related to the design of individual transmission assets and facilities (i.e. transmission lines and substations) are adequate for the ERCOT system and have found that transmission facilities designed in accordance with these standards and codes perform reliably. The AEP Companies' experience with Hurricane Harvey showed that facilities designed to modern standards were able to withstand a category 4 Hurricane; but also observed the failure of older facilities that were designed under less stringent criteria and that, due to age and environmental-related deterioration, may no longer meet the original design criteria. This observation is consistent with other empirical and engineering evidence that the AEP Companies have accumulated in its on-going efforts to address aging infrastructure. For this reason, the AEP Companies believe that a major focus should be on upgrading and modernizing our aging infrastructure to meet current standards and criteria. The AEP Companies alone have over 2,600 circuit-miles of transmission that is 60 years of age or older and was not designed under the current codes and criteria. In order to upgrade some aging transmission line infrastructure, a CCN filing may be required. AEP believes that the criteria for establishing "need" in these proceedings should allow bringing aging infrastructure up to current standards and requests the Commission's support in this regard. A detailed review of the current standards as they relate to the questions posed by the Commission is provided later in our comments.

Another critical aspect of ensuring reliability of service to customers during extreme events is ensuring that there are adequate transmission paths available and that the transmission system is planned and constructed in a manner consistent with the way that the system is operated on a real-time basis. When storms devastate an electric system, such as ice storms or tornadoes, the transmission system must be robust enough to provide service to customers in other areas of the system. While the damage may be severe to specific portions of the transmission system, energy flow in the transmission system is designed to be diverted around the damaged facilities to continue to reliably serve load in areas not geographically near the storm-damaged facilities. As new transmission lines are placed into service, more paths become available for energy to flow to loads. This benefits customers by enhancing reliability through new transmission paths, keeping their lights on in times of system stress.

From a transmission planning perspective, the AEP Companies evaluate the reliability of the transmission system and the need for new transmission paths through computer modeling and simulations. In these simulations, one or more transmission elements are removed from service (contingencies) and the resulting energy flows on the remaining elements are checked to ensure that they are within their specified thermal limits and that the voltages on the system are within acceptable limits. The loss of a single transmission element is referred to as a single "contingency", or an "N-1 contingency". NERC and the Electric Reliability Council of Texas (ERCOT) specify transmission planning criteria related to which contingencies should be analyzed and what constitutes acceptable transmission system performance during those contingency events. While the AEP Companies believe the current NERC and ERCOT transmission planning criteria are appropriate and provide a reasonable means of assessing the overall design of the transmission system, we believe that the existing criteria should be expanded to more closely align with the way the transmission system is operated.

The current NERC planning criteria (NERC TPL-001-4) specifies that for the loss of a single transmission element (N-1), or the outage of a single generating unit followed by the loss of a single transmission element (N-G-1), there should not be any loss of load (non-consequential) with the exception of any load directly served from the transmission element that was taken out of service (referred to as consequential load loss). The ERCOT criteria goes one step further and requires that the system be able to withstand the outage of an autotransformer followed by the loss of a single transmission element (N-A-1) with no non-consequential load loss. This analysis assumes that every remaining transmission system element is available for service. In contrast to the transmission planning criteria, transmission system operators position the transmission system (through generating unit output levels, transmission system configuration and/or load adjustments including potential load shed) to ensure thermal and voltage limits will be within acceptable limits when the next contingency occurs. So, following a single contingency event (N-1), system operators position the system to ensure that thermal loadings and voltages will be within acceptable limits following the next single contingency event (N-1-1). The AEP Companies believe that the ERCOT transmission planning criteria should be expanded to include an assessment of N-1-1 contingencies across all seasons and load levels and specify that non-consequential load loss is not acceptable. Implementation of N-1-1 criteria would more closely align the transmission planning criteria with the operational realities and result in a more robust transmission system that will be better positioned to withstand extreme weather events. The AEP Companies note that this N-1-1 transmission planning criteria has already been implemented successfully in other regions, and has been recently proposed in ERCOT through the ERCOT Planning Working Group.

Another issue of increasing concern is the growing number, complexity, and severity of Generic Transmission Constraints (GTC's) on the ERCOT grid. A GTC is a transmission constraint made up of one or more grouped transmission elements that is used to constrain flow between geographic areas of ERCOT for the purpose of managing stability, voltage, and other constraints that cannot be modeled directly in ERCOT's powerflow and contingency analysis applications. A growing number of GTC's have been deemed Interconnection Reliability Operating Limits (IROL's), which are defined by NERC as system operating limits that, if exceeded, could lead to system instability, uncontrolled separation, or cascading that adversely impact the reliability of the bulk electric system. Currently, the mitigations required to alleviate GTC's are evaluated as economic upgrades, as opposed to reliability upgrades, and are consequently subject to the benefit to cost test. AEP believes that there are significant reliability benefits associated with reducing or eliminating the GTC's that should be considered when evaluating the GTC exit strategies. At times when generation is needed the most, such as during extreme weather events, generation "behind" the GTC's may be curtailed due to the transmission constraints.

In order for Texas to benefit from the enhanced planning and grid update efforts identified above, there must be a continued focus on the installation of secure and reliable SCADA systems that feed enhanced real time operation tools. The synchronization of the real time models, data and situational awareness tools installed at both a Transmission Service Provider and Regional

Transmission Operator level is key to the reliability and resiliency success associated with the efforts outlined above. System operators must have full situational awareness of the real time loading on all interconnection facilities in order to proactively identify out of tolerance conditions ahead of time and take the appropriate action.

A. Transmission Line and Station Standards for Weather Conditions

1. <u>Temperature, Ice, and Wind</u>

The AEP Companies' transmission facilities are designed to meet or exceed existing standards for conditions such as temperature, icing, wind, flooding, and contamination conditions. The AEP Companies currently design transmission facilities to meet or exceed the loadings in the current National Electrical Safety Code (NESC: ANSI C2), the American Society of Civil Engineers (ASCE) Manual of Practice (MOP) No. 74: Guidelines for Electrical Transmission Line Structural Loading, and historical AEP internal load cases. All of these standards are periodically revised to include the latest research and experience. These standards combine physical risk parameters with historical weather data, such as wind speed, ice loading, and temperature, to provide maps that geographically identify the appropriate weather loading for a specific location.

The required structural strength requirements on transmission line and substation components are a result of the weather to which they are exposed, equipment weights, and conductor tensions. Extreme weather conditions resulting from wind speed, ice accumulation, and temperature are used to specify the required structural strength requirements. This fact was recognized as far back as 1916, when the NESC first included weather cases to be used in electrical facility design. The need for region-specific loading criteria was recognized and addressed in that code by dividing the United States into three distinct loading Districts - Heavy, Medium, and Light Loading. That method is still included in the NESC today. The NESC was originally intended as a safety code for the newly emerging electrical industry for electrical workers and the public. Since that time, concerns like reliability and resiliency have become more significant as electricity became more important to individual quality of life and the nation's economy. To address these newer concerns, the NESC added two extreme weather cases in 1977 and 2007 that must be followed in the design of transmission lines and substation terminal structures in addition to the original District load case - Extreme Wind, and Extreme Ice with Concurrent Wind. Wind speeds and ice thickness contours for each load case are depicted geographically on a map of the United States. The required geographic-specific wind speeds and ice thicknesses are determined by analyzing historical weather data and determining a statistical Mean Return Interval (MRI) of 50 years. The structural loading is calculated using the values obtained from the wind and ice contour maps by considering physical risk parameters to account for structure height, span length, gusts, and terrain exposure factors.

The maps and methodology for these two load cases in the NESC originates with ASCE7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures. This standard is the basis for Building Codes throughout the Unites States and for ASCE's MOP 74. MOP 74 provides maps similar to the NESC maps with the exception of the Mean Return Interval used. The current ASCE maps use a 100-year MRI, which results in designing of transmission and substation structures to the most up-to-date standards. The NESC is expected to adopt these new maps in its next revision cycle. To account for the delay in adopting the newest maps, AEP uses both the NESC and ASCE load cases in its design process.

In addition to the NESC and ASCE load criteria, the AEP Companies apply cases that are internally generated. These weather cases have evolved in AEP over many decades and have proven successful to promote reliable and resilient performance of our transmission system. Some of these load cases are based on historical weather conditions and experience and are intended to increase the reliability of our system over and above what would be achieved by just the standard load requirements. Other AEP internal load cases provide additional longitudinal capacity, which limits cascading type failures. For example, during Hurricane Harvey, a transmission line experienced a cascading type failure where numerous structures failed. Being of an older design, these structures did not have the longitudinal capacity to resist the cascading failure. After that incident it was determined that if the line had been designed to current AEP standards, it would have resisted the cascade, greatly limiting the damage. Similarly, other line and station structure failures experienced during Harvey had also been built without benefit of this modern loading criteria.

This loading philosophy is applicable to the design of certain line-loaded substation structures too. In addition to the extreme wind and ice conditions, station structures are designed to tighter deflection requirements to limit the stress on electrical equipment and allow operation in certain circumstances.

In addition to the comprehensive loading requirements, materials are specified and line and station components are designed and constructed to exacting industry standards and guidelines published by ASCE, ANSI, and IEEE. Where the AEP Companies find certain provisions deficient, we supplement these requirements, especially with regard to material testing and qualification. AEP is an Electric Power Research Institute (EPRI) member and leverages their research for the betterment of our installations. These standards along with the AEP Companies' internal specifications also specify operating temperature ranges for most station equipment. This range typically runs from -22°F to 104°F.

In addition to structural requirements, the NESC also specifies minimum clearances between live electrical conductors and ground or other objects under certain weather conditions such as ice, wind, flood, and high temperatures to ensure safe, reliable operation of the electrical system.

2. <u>Flood</u>

Known flood zones are identified during the transmission line siting processes and are considered during the line design phase. Structure heights are selected to provide the required clearance over the anticipated high water level in adherence with the NESC or USACE requirements. Structurally, flooding in and of itself does not raise concerns for transmission line structures. The structures can withstand being in a flooded area. The danger from flooding comes from being in a high water flow area. This flow can wash away the soil around a structure foundation, compromising the strength of the structures. When it is determined this could be a problem, foundations are typically deeper than normal to account for the loss of soil around the top of the foundation. Another issue that stems from high water flow is possible impact due to floating debris in the floodwaters. In this case, the structure is specified with thicker plate or surrounded with concrete to protect against impact loads. Station pads are designed to be above the 100 year flood plain or local jurisdiction requirements. This ensures station equipment will be above anticipated flood levels.

3. <u>Contamination</u>

In most of Texas, the AEP Companies use insulators for lines and stations that are specifically designed to operate in a high contamination environment. The mechanism for this contamination is different based on location, such as salt water on the coast, dust in west Texas, or particulates from wild fires. The AEP Companies have transmission facilities over a wide area of Texas that stretches from the Rio Grande Valley to the southern Gulf Coast, through the hill country, and into North Texas. The lack of natural insulator washing due to insufficient rainfall in drought prone areas can lead to dust build up on transmission insulators. Dust build up can lead to excessive leakage current and premature failure of the insulator. In the Gulf Coast area, the contamination is caused by salt in the air accumulating on an insulator. The effect of salt contamination is similar to dust contamination and can also lead to premature insulator failure. The insulators the AEP Companies use in these areas are resistant to leakage current and provide better performance in these contamination prone areas.

4. <u>Additional design criteria are not necessary</u>

The AEP Companies do not believe that additional design criteria are necessary for improved transmission system performance during extreme weather events. The current standards, backed by decades of history and research, are adequate for building a strong, reliable system. However, the additional measures addressed above could enhance the resilience, redundancy and reliability of the ERCOT grid and provide the improvement sought by the Commission. Aging transmission system facilities, designed to older code requirements, cannot perform like facilities designed to modern codes. Increased redundancy could also increase the reliability and resiliency of the system during extreme weather events. Along with improving performance, such a program will have the added benefit of increasing system load serving capacity.

B. Operations and Maintenance

The AEP Companies routinely conduct operations and maintenance consistent with existing standards and best practices on its transmission facilities across Texas. Below are a few of the categories regularly addressed.

1. <u>Line and Station Inspections</u>

Types of transmission line inspections commonly employed by the AEP Companies include aerial inspection, comprehensive helicopter inspection, walking inspection and ground-line inspection and treatment. Depending on the types of line structures, age of the line, remoteness or proximity to crew resources, geophysical terrain, etc., the AEP Companies select an appropriate combination of inspection methods to ensure the reliability and safety of the transmission line. The AEP Companies' inspection program ensures that each transmission line inspection is performed in a uniform and consistent manner so that a fair evaluation is given to each transmission line throughout the entire AEP Transmission System.

The AEP Companies' conduct routine station maintenance activities to ensure the reliability of the stations. These activities include, but are not limited to: grounds maintenance (such as weed mitigation and storm water inspections), routine station inspections, battery testing, infrared scans, and transformer sampling.

2. Transmission Protection and Control

The AEP Companies align the transmission protection and control maintenance with the time-based schedules and activities prescribed in the NERC standard PRC-005. These intervals and maintenance activities are followed as a best practice on all non-PRC-005 assets and are a requirement for all assets that are applicable to PRC-005.

3. Forestry

AEP Transmission Forestry conducts two annual aerial patrol inspections of all lines above 200kV to capture electronic notes of identified vegetation conditions. AEP Transmission Field Services conducts an annual aerial patrol inspection on all lines below 200kV to capture electronic notes of identified vegetation conditions, which are provided to the AEP Transmission forester. The identified vegetation conditions allow the AEP Transmission forester to determine reactive and proactive vegetation management strategies.

III. CONCLUSION

The AEP Companies appreciate the opportunity to provide these comments and look forward to working with the Commission and other stakeholders to provide additional input in this project.

Date: June 23, 2021

Respectfully submitted,

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ON BEHALF OF AEP TEXAS AND ELECTRIC TRANSMISSION TEXAS